

## UNITED STATES PATENT AND TRADEMARK OFFICE



APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/003,386	10/30/2001	Mun-Mo Jeong	9898-188	5352
75	90 03/27/2003			
MARGER JONHSON & McCOLLOM, P.C. 1030 S.W. Morrison Street Portland, OR 97205			EXAMINER	
			GEBREMARIAM, SAMUEL A	
	·		ART UNIT	PAPER NUMBER
		•	2811	
			DATE MAILED: 03/27/2003	

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)				
	10/003,386	JEONG, MUN-MO	,			
Office Action Summary	Examiner	Art Unit				
	Samuel A Gebremariam	2811				
The MAILING DATE of this communication app ars on the cover sheet with the correspondence address Period for Reply						
A SHORTENED STATUTORY PERIOD FOR REPLY THE MAILING DATE OF THIS COMMUNICATION.  - Extensions of time may be available under the provisions of 37 CFR 1.13 after SIX (6) MONTHS from the mailing date of this communication.  - If the period for reply specified above is less than thirty (30) days, a reply - If NO period for reply is specified above, the maximum statutory period w  - Failure to reply within the set or extended period for reply will, by statute,  - Any reply received by the Office later than three months after the mailing earned patent term adjustment. See 37 CFR 1.704(b).  Status	within the statutory minimum of thirty (30) days ill apply and will expire SIX (6) MONTHS from cause the application to become ABANDONEI	nely filed s will be considered timely. the mailing date of this communication. D (35 U.S.C. § 133).				
1) Responsive to communication(s) filed on 20 N	lovember 2002 .					
	s action is non-final.					
3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i> , 1935 C.D. 11, 453 O.G. 213.						
Disposition of Claims  A\M Claim(s) 1.13 and 21.25 is/are pending in the	application					
4) Claim(s) 1-13 and 21-25 is/are pending in the application.						
4a) Of the above claim(s) is/are withdrawn from consideration.						
5) Claim(s) is/are allowed.		•				
6) Claim(s) 1-13 and 21-25 is/are rejected.						
7) Claim(s) is/are objected to.	alastias rasuiramant					
8) Claim(s) are subject to restriction and/or Application Papers	election requirement.					
9)☐ The specification is objected to by the Examiner	•					
10) The drawing(s) filed on is/are: a) □ accepted or b) □ objected to by the Examiner.						
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).						
11) The proposed drawing correction filed on	is: a) ☐ approved b) ☐ disappro	ved by the Examiner.				
If approved, corrected drawings are required in reply to this Office action.						
12) The oath or declaration is objected to by the Examiner.						
Priority under 35 U.S.C. §§ 119 and 120						
13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).						
a) All b) Some * c) None of:						
1. Certified copies of the priority documents have been received.						
2. Certified copies of the priority documents have been received in Application No						
<ol> <li>Copies of the certified copies of the prior</li> <li>application from the International Bur</li> <li>See the attached detailed Office action for a list of</li> </ol>	eau (PCT Rule 17.2(a)).	_				
14) Acknowledgment is made of a claim for domestic	priority under 35 U.S.C. § 119(e	e) (to a provisional application	1).			
a) ☐ The translation of the foreign language prov 15)☐ Acknowledgment is made of a claim for domestic	• •					
Attachment(s)						
<ol> <li>Notice of References Cited (PTO-892)</li> <li>Notice of Draftsperson's Patent Drawing Review (PTO-948)</li> <li>Information Disclosure Statement(s) (PTO-1449) Paper No(s)</li> </ol>	5) Notice of Informal F	(PTO-413) Paper No(s) Patent Application (PTO-152)				

According to rule 1.126 claims 14-18 have been renumbered as claims 21-25 respectively.

## Claim Rejections - 35 USC § 103

- 1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
  - (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
- 2. Claims 1-13, are rejected under 35 U.S.C. 103(a) as being unpatentable over Bost et al., US patent No. 5,231,053 in view of admitted prior art.

Regarding claim 1, Bost teaches (figs. 2-7) a method for manufacturing a semiconductor device comprising: forming interconnection layer (22), including a capping layer (30) the capping layer defining a contact resistance, and an etching stopper (32) on a semiconductor substrate (26); forming an interlayer insulating layer (34) overlying the interconnection layer (22); forming a first contact hole (hole formed within layer 34) exposing a surface of the etching stopper (32); removing portion of the etching stopper exposed by the first contact hole, thereby forming second contact hole (hole formed within layer 32) to leave the capping layer of the interconnection layer at substantially the same thickness such that the contact resistance of the interconnection layer are substantially uniform; and forming a conductive layer (38) within the second hole.

Art Unit: 2811

Bost does not explicitly teach forming a plural interconnection layers and the formation first and second contact holes.

It is conventional and also taught by admitted prior art (fig. 1) to form plural interconnection layer (14) and contact holes (20a, 20b and 20c, page 1, line 23-29).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form more than one interconnection layers and contact holes taught by admitted prior art in the process of Bost in order to form a functional device.

The modified process would result in an interconnection layers at substantially the same thickness such that the contact resistances of the plural interconnection layers are substantially uniform.

Regarding claim 2, Bost teaches (figs. 2-7) substantially the entire claimed process of claim 1 above including the method of claim 1 further comprising forming third contact holes (hole formed in layer 30) by slightly etching a portion of the capping layer (30) exposed by the second contact holes before forming the conductive layer, and wherein the conductive layer is formed within the second contact holes and the third contact holes.

Regarding claim 3, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is formed only in the second and third contact holes.

Regarding claim 4, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is an upper interconnection layer filling the

Art Unit: 2811

second and third contact holes and covering the top surface of the interlayer-insulating layer (fig. 6, col. 4, lines 44-57).

Regarding claim 6, Bost teaches substantially the entire claimed method of claim 1 above including the etching stopper is formed of an inorganic anti-reflecting layer (32) (ARL) that is titanium nitride.

Regarding claim 7, Bost teaches substantially the entire claimed method of claim 1 above including the interconnection layer is a metal layer containing aluminum (col. 2, line 61-65).

Regarding claim 8, Bost teaches substantially the entire claimed method of claim 1 above including the capping layer (30) is formed of TiN (col. 3, line 6-25).

Regarding claim 9, Bost teaches substantially the entire claimed method of claim 1 above including the interlayer-insulating layer (34) is formed of silicon oxide layer (col. 3, line 52-61).

Regarding claim 10, Bost teaches (figs. 2-7) substantially the entire claimed method of claim 1 above including the interconnection layer, the capping layer, and the etching stopper are formed by sequentially depositing material layers for forming the interconnection layer, the capping layer, and the etching stopper, and patterning the material layers by the same etching process.

Regarding claim 11, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is formed only in the second contact hole (fig. 6).

Art Unit: 2811

Regarding claim 12, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is an upper interconnection layer filling the second contact hole and covering the top surface of the interlayer insulating layer (fig. 6, col. 4, lines 44-57).

Regarding claim 13, Bost teaches substantially the entire claimed method of claim 1 above including the first contact hole is formed by using a dry etching method (col. 4, line 1-8).

Regarding claim 21, Bost teaches substantially the entire claimed method of claim 1 above including the capping layers are etched to form uniform thickness among the second contact holes.

Regarding claim 22, Bost teaches substantially the entire claimed method of claim 1 above including the second contact holes expose a top surface of the capping layers.

Regarding claim 23, Bost teaches (fig. 5) substantially the entire claimed process of claim 1 above including selectively removing the material layer (30) in such a manner that the capping layers (30) within the contact holes are of uniform thickness.

Regarding claim 24, Bost teaches (fig. 5) substantially the entire claimed process of claim 1 above including the capping layers are etched to form a uniform thickness in the contact holes.

Regarding claim 25, Bost teaches (fig. 5) substantially the entire claimed process of claim 1 above including the contact holes expose a top surface of the capping layers.

Art Unit: 2811

Claim 5, is rejected under 35 U.S.C. 103(a) as being unpatentable over Bost and admitted prior art and in view of Maniar et al. US patent No. 5,702,981.

Regarding claim 5, Bost teaches substantially the entire claimed method of claim 1 above including the second and third contact holes are formed by performing a dry etching method (col. 4, lines 1-8)

Bost in view of admitted prior does not explicitly teach using an etchant having a low etching selectivity between the etching stopper and the capping layer.

The use etchant having low etching selectivity between etch stop and capping layer is conventional and Maniar also teaches (fig. 4, col. 6, lines 1-24) etching etch stop layer (40) and capping layer (38) using etchant that etches the capping layer slower than the etch stop layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was method to incorporate the process step taught by Maniar in the process of Bost in order to have better control on the etching process.

## Response to Arguments

3. Applicant's arguments with respect to claims 1-13 and 21-25 have been considered but are moot in view of the new ground(s) of rejection.

## Conclusion

4. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

Art Unit: 2811

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Samuel Admassu Gebremariam whose telephone

number is 703 305 1913. The examiner can normally be reached on 8:00am-4: 30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Tom Thomas can be reached on (703) 305-7646. The fax phone numbers

for the organization where this application or proceeding is assigned are (703) 308-7722

for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or

proceeding should be directed to the receptionist whose telephone number is (703) 308-

0956.

Samuel Admassu Gebremariam March 19, 2003

TOM THOMAS SUPERVISORY PATENT EXAMINER TECHNOLOGY CENTER 2800

Page 7